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On the Cholera Mortality in Hull during the Epidemic of 1849.

By HENRY COOPER, M.D.

[Read before the Statistical Section of the British Association at Hull,
9th September, 1853.]

THE analysis of the mortality of the epidemic of 1849, so far as relates to this borough, which I now present to the Section, was projected with the concurrence, and has been effected through the kind assistance of the late lamented registrar, Mr. Thorney, and of the registrar for Sculcoates, Mr. Chatham, who readily acceded to my proposal to classify the cholera and diarrhœa deaths of the fearful period to which I allude, from the official records in their hands. Their returns have been the materials which I have analyzed and placed in a connected and synoptical form in the tables and diagrams which I now present, and from which I shall venture to draw some general inferences.

I have taken the four months, from July to October inclusive, as the period of the epidemic outbreak of the disease. Isolated cases had occurred for some weeks previously; and, as is usual, severe and intractable forms of diarrhœa preceded and accompanied the attack. The termination of the outbreak was abrupt, differing, in this respect, from its outset, which was gradual and insidious; and there was, to say the least, a *coincidence* between the disappearance of the disease and the adoption of preventive measures of treatment (house-to-house visitation and checking the early diarrhœa), which was very remarkable. The greatest mortality was attained in the first week in September; and the system of house-to-house visitation, of which I was superintendent in this district, was commenced on the 20th, from which time the disease rapidly declined, and ceased altogether in the second week in October.

Regarding the general character and extent of this outbreak, the Registrar-General, in his "Report on Cholera in England," states, that Hull, in proportion to its population, suffered more from cholera than any district in the kingdom. In Hull (*viz.*, the old town and Myton) it was fatal at the rate of 241 to every 10,000; in Sculcoates, at the rate of 152 to every 10,000. We shall, I believe, turn this awful lesson to the best account by investigating the circumstances and conditions under which this great mortality has occurred; and thus approach, as near as the nature of the subject will allow, to the causes of its extraordinary virulence.

It may be premised that the town stands on a surface practically level, and that this level is so little above the low water of the tidal rivers (the Hull and the Humber), which constitute the natural outfall, that efficient natural drainage is almost impracticable. The only irregularities of surface are caused by artificial works, *viz.*, the excavation of the docks and the mounds of earth thrown out of them on the one hand, and the hollows formed by digging out clay for bricks, on the other; for the subsoil is a stiff retentive clay, very well adapted for brick-making, and, therefore, almost impervious to water. There is a difference between the highest and lowest levels thus

formed of about 10 feet; but the fall obtained from the lowest levels into the adjoining rivers, which is only available for a limited period of each tide, is practically insufficient for their effective drainage; and accordingly, in the new plans for the drainage of the borough, recently sanctioned by the Board of Health, the sewage is to be pumped from a level many feet below the outfall of the present drainage system. Overcrowding is also a prevalent evil in many parts of the borough; and the mode of construction of tenements, and of the other lower classes of dwellings, has been, prior to the control now exercised by the Local Board of Health, very unfavourable to ventilation.

The first general analysis (see Table I.) which I have made of the mortality enumerates the total number of sufferers from cholera and diarrhœa, and states the proportion of these to the whole population, which has been assumed at that period to have been 80,000; the census of 1851 giving 82,000. The cases are further arranged according to sex, the numbers of males and females suffering from each disease being distinguished. The proportion between these numbers is further compared with that which obtains between the sexes in the whole population. This comparison corrects the first impression given by the tables, and which I believe to be the general one, that cholera is more fatal to females than to males. It is true that the female deaths exceed the male in the proportion of 975 to 885; but the female population exceeds the male in a still greater ratio—thus the deaths are 1 male to 1·1 female—the numbers living in this borough are in the proportion of 1 male to 1·14 female, giving a small difference in favour of female mortality.

And this corresponds with the observation of the Registrar-General, deduced from the whole field of cholera mortality. He states the deaths of males at 26,108, of females at 27,185; but correcting for the disproportion in numbers living of the two sexes, he gives, as the male mortality, 30·2 to every 10,000, or 1 in 331; the female, 30 to every 10,000, or 1 in 333. In the deaths from diarrhœa, the proportion between the sexes is more nearly balanced, so that, applying the same correction for numbers living, the result would be still more favourable for females; but the total number of cases I consider too small to furnish a safe deduction.

In the third table I have made an analysis of deaths from cholera and diarrhœa, according to the *Age* of the sufferers, dividing the ages in all but the upper and lower rows of figures into quinquennial periods. The same principle of correction must be applied here as in the case of sex, as there are a greater number of infants living under one year than of persons at any other age, and the mortality from all causes is also greater in proportion to numbers. This correction is attempted by introducing in the fourth column the annual mortality per cent. from all causes at each period of life, thus affording an opportunity of comparing the ordinary mortality with the mortality from cholera for the same age. The excess of infantile mortality is the most striking feature exhibited in this table; but great as it is, it is much understated when compared with other periods, inasmuch as it is a return of deaths taking place in one year of life only (*viz.*, under 1), while the others represent the numbers dying in five-year periods, and would require to be divided by five to make the comparison just.

I have, therefore, cut off this first row of figures from the rest of the table by an horizontal line. The same remark applies to the ages above 70. which are divided into decennial instead of quinquennial periods, and are, therefore, similarly separated.

Comparing the deaths at given five-year periods with the average mortality from all causes at the same age, as in the case of infant mortality just given, the next period of greatest mortality occurs from 30 to 35, a period at which the annual mortality is very low (1·160 for this borough). This mortality is remarkable, as occurring at a period when the powers of life are in their fullest vigour, and when, consequently, the most resistance is opposed by the system to the inroads of disease generally. It appears to afford another link of affinity between this mysterious disease and the fatal pestilences of bygone times, and the graver forms of fever in our own, which are seen to strike down the strongest and those least liable to ordinary forms of disease, if exposed to their influences in circumstances favouring the attack. Another period of great apparent proclivity, according to this table, occurs at a time a little beyond the grand climacteric, about 55 to 60, where we have a great mortality indicated compared with the annual ordinary rate shown in the fourth column. The greatest immunity seems to be enjoyed in the periods between 15 and 25, and between 40 and 60.

Turning to the Diarrhoea Age Table (No. IV.), although, perhaps, the numbers are too small to draw any safe deduction from, we cannot but be struck with the enormous excess of infant deaths, the immunity of the middle periods of age, or those of greatest resistance, and the excess again in advanced life, where the powers are failing. In this respect, diarrhoea, even when connected with cholera (and therefore assumed to partake of its specific character), seems to follow the ordinary law of disease, though far in excess of that law, and separates itself from cholera and other fatal epidemics.

In the second table, the influence of occupation and station in life on the mortality of cholera is approximately shown. It will not be necessary to do more than refer generally to the table itself, which carries on its face the information it is calculated to convey. A division is made first into the labouring and the well-off classes, each of which is analyzed; the former into out-door and sedentary workmen (some of the most important of which are specified) into sailors, and into the wives, females, and children of these classes; the latter is shortly divided according to employment. The general result is that 1,738 of the labouring classes, and 122 of the well-off classes, perished; and, if we assume that the borough contains 67,000 of the former, and 13,000 of the latter, we shall have a proportion of 1 death to every 38·55 of the labouring classes, and 1 to 106·55 of the middle and upper.

TABLE I.

Mortality from Cholera and Diarrhoea in the Borough of Kingston-upon-Hull, from June to October, 1849, (inclusive).

Total Deaths, 2,115,	{ Cholera..... 1,860	{ Males..... 885	{ Or 1 male to 1·1 females.
or 1 in 37·82	{ or 1 in 43·01.	{ Females 975	{ (The proportion of <i>all</i>
of the	{ Diarrhoea..... 255	{ Males..... 129	{ <i>living</i> being 1 male to
entire population.	{ or 1 in 313·72.	{ Females 126	{ 1·14 females.)

TABLE II.
Analysis of Cholera Deaths, according to Occupation.

LABOURING CLASSES.		
Paupers and Prisoners	27	
Out-door Labourers	237	
Cabmen and Police	22	
Sedentary Labourers (not specified).....	120	
		406
Specified Artizans.		
Joiners	61	
Blacksmiths and Engineers	56	
Tailors and Shoemakers.....	74	
Painters	15	
		206
Sailors.....		110
Wives, widows, and children of the same class.....	734	
Spinsters of same class	153	
Unclassified, chiefly children of same	129	
		1,016
		1,738
WELL-TO-DO CLASSES.		
Clerks	16	
Tradesmen	60	
Retired, Pensioners, &c.	18	
Professional (2 medical)	6	
Gentry.....	22	
		122
		1,860
	Death.	Living.
Estimated number of Labouring Classes in borough 67,000 = 1 to every	38.55	
„ „ Well-to-do „ 13,000 = 1 „	106.55	

TABLE III.
Ages of Cholera Deaths.

Periods of Life.	Whole Number Dying at each Period.	Per-Centage of Deaths at each Age to whole Deaths (1,860).	Annual Mortality per Cent. at each Period. (For Comparison.)
Under 1	84	4.51 (× 5 = 22.5)	24
1 to 5	174	9.46	1.16
5 „ 10	136	7.36	.508
10 „ 15	82	4.43	.780
15 „ 20	59	3.17	1.104
20 „ 25	124	6.66	
25 „ 30	160	8.60	
30 „ 35	161	8.65	1.160
35 „ 40	104	5.55	
40 „ 45	130	6.98	
45 „ 50	103	5.53	3.21
50 „ 55	101	5.43	
55 „ 60	158	8.59	
60 „ 65	84	4.51	6.99
65 „ 70	72	3.87	
70 „ 80	67	3.59	
80 „ 90	48	2.58	15.89
Above 90	13	.69	
Total	1,860		33

TABLE IV.
Ages of Diarrhœa Deaths.

Periods of Life.	Whole Number of Deaths at each Period.	Per-Centage of Deaths at each Age to whole Deaths (256).	Annual Mortality per Cent. at each Period. (For Comparison.)
Under 1	90	35·55	24
1 to 5	59	23·04	1·16
5 „ 10	21	8·28	·508
10 „ 20	6	2·34	·784
20 „ 40	10	3·90	1·295
40 „ 60	26	10·05	3·99
Above 60	44	17·23
Total	256		

I have attempted, though I fear very ineffectively, to show in the map which I exhibit the localities in which the disease was most fatal. The shading indicates, by its relative intensity, the lowness of the level and consequent presumed inefficacy of the drainage. The dots or dark marks are placed wherever cases of cholera occurred, each mark indicating a death by cholera in the street or court where it took place; these dots will, by their aggregation, show strikingly the spots of greatest mortality. It is obvious that the preponderance of these dots exhibits, in many cases, merely the excess of population in a given district, for where the greatest number are living, the number of deaths will also be the greatest, supposing there is no disturbing cause determining the mortality to one place in preference to another. But beyond this obvious cause of excess, and not accounted for by it, we have on this map three principles indicated as influencing the prevalence of cholera in any particular locality. First, the influence of low position and deficient dryness; second, the effect of over-crowding even in well-drained districts; and lastly, the influence of the habits of the inhabitants, their means of sustenance, and general social condition. Unfortunately, these causes so constantly co-exist, that it is extremely difficult to find instances in which they can be clearly separated, and the effects of each satisfactorily estimated. Some of the districts here depicted will, however, afford illustrations of each principle. In the Drypool district, for instance, we have a deep blotch of accumulated deaths—here we have all the above causes in operation, but especially defective drainage and damp and filthy surface. In Leadenhall Square and its neighbourhood the drainage belongs to the best system of sewerage in the town, and is, on the whole, good; but the overcrowding of tenements and lodging-houses is great, and the social habits deplorably bad. In Mill Street (the quarter of the low Irish), the same two causes are in operation, but particularly over-crowding. The Pottery districts suffered dreadfully, as the dark marks sufficiently attest. It will also be seen by the deep tints of the shading, that the levels are very low; the drainage is wanting, or so bad as to be worthless, as the recent underground survey has abundantly proved; the two other elements of excessive mortality are not present. But there is a marked freedom from disease in the more elevated districts which surround the docks, and which enjoy other favourable hygienic conditions, which, taken in connexion with the instances above noted, sufficiently prove the correctness of my positions.